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PATENT REQUEST : STANDARD PATENT

I/We, being the person/s identified below as the Applicant, request the grant of a patent to the person/s indicated below as the Nominated Person/s, for an invention described in the accompanying standard complete specification.

Full application details follow.

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[54] Invention Title:
The cross coupling linking-up wheel train of nonharmonious unequal ratio complex number wheel trains and the device

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(12) PATENT ABSTRACT (11) Document No. AU-A-19415/92
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(54) Title
GEAR TRAIN WITH VARIABLE RATIO

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Gear train (101, 102, 103, 104) of gears, belt pulleys, friction wheels or chain wheels having a restricting torsion coupler (106) and single direction bearing (105) has the ability to change the speed ratio according to load automatically or having different output speed ratios for diffferent rotation directions.

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ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

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Invention Title: The cross coupling linking-up wheel train of nonharmonious unequal ratio complex number wheel trains and the device

The following statement is a full description of this invention, including the best method of performing it known to me:-

TITLE

The Cross Coupling Linking-up Wheel Train of Nonharmonious Unequal Ratio Complex Number Wheel Trains and the Device in Application

SUMMARY OF THE INVENTION

As everyone knows, the coupling of conventional mechanical wheel train is limited to be between axle and axle, if complex number wheel trains were coupled, the cross coupling wheel train of the driving wheels have identical driving ratio; otherwise the phenomenon of being in mesh and unable to drive will occur. The present invention is to provide an innovative device for the operation and application of different speed ratio differential nonharmonious cross coupling wheel train for the application of the change of the speed ratio according to load automatically or providing different output speed ratio on the occurring of obverse and reverse turns.

BRIEF DESCRIPTION OF THE DRAWINGS :

Figure 1 is the schematic drawing of the fundamental principle of the structure of the cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device in application.

Figure 2 is the schematic drawing of the embodiment of the application of the cross coupling linking-up wheel trains of the nonharmonious unequal ratio complex number wheel trains in same direction driving organism.

Figure 3 is the schematic drawing of the embodiment of the application of the cross coupling linking-up wheel

train of the nonharmonious unequal ratio complex number wheel trains and the device of application in multiple stop organism.

Figure 4 is an embodiment of the multi-speed gears further made into a coupling structure.

Figure 5 is the schematic drawing of the embodiment cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device of application to be connected to the operating and controlling master clutch;

Figure 6 is the schematic drawing of the action characterics of Figure 5.

DETAILED DESCRIPTION OF THE INVENTION

As shown in the brief description, if complex number wheel trains are coupled between conventional axles, the cross coupling wheel trains between the driving wheels should have identical driving ratio, the present invention is to provide the operation and the device of application of the differential nonharmonious linking-up wheel trains with different speed ratio for the application to be able to change the speed ratio according the load automatically or having different output speed ratio on the occurring of obverse and reverse turns, the schematic drawing of the principle is shown as in Figure 1, the structure comprises to provide the driving wheel train having different speed ratio to be able to slide along with the torsion as well as the driving train having the function of single direction driving, in which

---- axle A performs single revolving or obverse and revolving for input and output;

---- the driving wheel train to be constituted by the

gear, friction-wheel, belt pulley and chain wheel or the combination of these components in which the driving wheel 101 is locked steadily on axle A; driving wheel 104 is locked steadily on axle B; driving wheel 102 is combined with the restricting torsion coupler 106 which is able to restrict the transmission torsion and then inserted into axle A and coupled with the driving wheel 104 of the axle B; driving wheel 103 is to combine with a single direction bearing 105 (or other single direction driving device) and then inserted into the axle B. The feature is that the speed ratio of the driving wheels 101 and 103 is different from the speed ratio of the driving wheels 102 and 104; the restricting torsion coupler is able to provide the sliding idle running to be produced once excessive transmission torsion exists between the driving wheel 102 and axle A.

According to the principle of the above structure, while the driving wheel 103 drives counterclockwise against the single direction bearing of the axle B, the driving wheel 102 is larger than the driving wheel 104 and the driving wheel 103 is larger than the driving wheel 101. The applications of the above structure will comprise:

(1) Axle A is the primary axle as looking at it from the direction of the arrow, it drives clockwise, and the axle B is in the state of output axle.

(2) Axle A is the primary axle as looking at it from the direction of the arrow, it drives counterclockwise, and the Axle A is in the state of output axle.

(3) Axle A is the primary axle as looking at it from

the direction of the arrow, it performs bidirectional driving, and the axle B is in the state of output axle.

(4) Axle B is the primary axle as looking at it from the direction of the arrow, it drives clockwise, and the axle A is in the state of output axle.

(5) Axle B is the primary axle as looking at it from the direction of the arrow, it drives counterclockwise, and the axle A is in the state of output axle.

(6) Axle B is the primary axle as looking at it from the direction of the arrow, it performs bidirectional driving, and the axle A is in the state of output axle.

The above applications and efficacy is discussed respectfully as follows:

---- Regarding (1) axle A to be the primary axle to drive clockwise as looking at it from the direction of the arrow, the axle B is an output axle, while axle A turns and the load of axle B is less than the transmission torsion of the restricting driving device 106, on account of the driving wheel 102 speeding up the driving wheel 104, and the speed of the driving wheel 103 is lower due to its diameter being larger than that of the driving wheel 101, it forms idle running with the axle B, at this time axle B is sped down to output counterclockwise with moderate speed; if the lead of the axle B increased to exceed the rated torsion of the restricting torsion driving device 106, sliding will occur between the axle A and the driving wheel 102 to cause axle B to receive the same direction lower speed and large torsion output of the driving wheel 101 against the driving of the driving wheel 103. The present design is applicable to the driving of

electric tools, hoist, communication machinery, or mechanical organism.

---- Regarding (2) axle A to be the primary axle as looking at it from the direction of the arrow, while it drives counterclockwise, axle B does not perform output, axle A and driving wheel 102 present the state of sliding.

---- Regarding (3) axle A to be the primary axle as looking at it from the direction of the arrow, it performs bidirectional driving, axle B is the output axle providing the feature of the mixing of (1) and (2); if to install the single direction bearing adversely, it is able to attain the same function in adverse direction.

---- Regarding (4) axle B to be the primary axle as looking at it from the direction of the arrow, it drives clockwise, axle A is the output axle, to be sped up to output counterclockwise, and the driving wheel 102 produces sliding against axle A via the restricting torsion driving device 106.

---- Regarding (5) axle B to be the primary axle as looking at it from the direction of the arrow, it drives counterclockwise, axle A is the output axle presents clockwise speeding down restricting torsion output.

---- Regarding (6) axle B to be the primary axle as looking at it from the direction of the arrow, it performs bidirectional driving, axle A is the output axle presenting the feature of the combination of (4) and (5); if to install the single direction axle adversely, it is able to attain the same function in adverse direction.

Figure 2 is the embodiment of the cross coupling linking-up wheel train of the application of the

nonharmonious unequal ratio complex number wheel trains and the device trains and the device of application in same direction driving organism, in the drawing the primary wheel and the driving wheel are chain wheels to drive by means of a chain or belt pulley to drive by means of the belt; in which

---- the driving wheel 201 is locked steadily on the axle A; the driving wheel 204 is locked steadily on the axle B; the driving wheel 202 is to combine with the restricting torsion coupler 206 which is able to restrict the driving torsion, and then inserted into axle A to drive together with the driving wheel 204 of the axle B in the same direction by means of a chain or belt; the driving wheel 203 is to combine with a single direction bearing 205 (or other single driving device) and then inserted into axle B; the feature is that the speed ratio of the driving wheels 201 and 203 is different from that of the driving wheels 202 and 204; the restricting torsion coupler is able to produce sliding idle running in case excessive transmission torsion appeared between the driving wheel 202 and axle A.

According to the above principle of structure, while single direction bearing 205 causes the driving wheel 202 to drive against axle B clockwise to look at it from the direction of the arrow, the driving wheel 202 is larger than the driving wheel 204, and the driving wheel 203 is larger than the driving wheel 201, it is discovered that the application of the above structure comprise:

(1) Axle A is the primary axle to drive clockwise as looking at it from the direction of the arrow, and axle B

is in the state of an output axle.

(2) Axle A is the primary axle to drive counterclockwise as looking at it from the direction of the arrow, and axle B is in the state of an output axle.

(3) Axle A is the primary axle to perform bidirectional driving as looking at it from the direction of the arrow, and axle B is in the state of an output axle.

(4) Axle B is the primary axle to drive clockwise as looking at it from the direction of the arrow, and axle A is in the state of an output axle.

(5) Axle B is the primary axle to drive counterclockwise as looking at it from the direction of the arrow, and axle A is in the state of an output axle.

(6) Axle B is the primary axle to perform bidirectional driving as looking at it from the direction of the arrow, and axle A is in the state of an output axle.

The above applications and efficacy is discussed respectfully as follows:

---- Regarding (1) axle A to be the primary axle to drive clockwise as looking at it from the direction of the arrow, the axle B is an output axle, while axle A turns and the load of axle B is less than the transmission torsion of the restricting driving device 106, on account of the driving wheel 102 speeding up the driving wheel 104, and the speed of the driving wheel 103 is lower due to its diameter being larger than that of the driving wheel 101, it forms idle running with the axle B, at this time axle B is sped down to output counterclockwise with

moderate speed; if the lead of the axle B increased to exceed the rated torsion of the restricting torsion driving device 106, sliding will occur between the axle A and the driving wheel 102 to cause axle B to receive the same direction lower speed and large torsion output of the driving wheel 101 against the driving of the driving wheel 103. The present design is applicable to the driving of electric tools, hoist, communication machinery, or mechanical organism.

---- Regarding (2) axle A to be the primary axle as looking at it from the direction of the arrow, while it drives counterclockwise, axle B does not perform output, axle A and driving wheel 102 present the state of sliding.

---- Regarding (3) axle A to be the primary axle as looking at it from the direction of the arrow, it performs bidirectional driving, axle B is the output axle providing the feature of the mixing of (1) and (2); if to install the single direction bearing adversely, it is able to attain the same function in adverse direction.

---- Regarding (4) axle B to be the primary axle as looking at it from the direction of the arrow, it drives clockwise, axle A is the output axle, to be sped up to output counterclockwise, and the driving wheel 102 produces sliding against axle A via the restricting torsion driving device 106.

---- Regarding (5) axle B to be the primary axle as looking at it from the direction of the arrow, it drives counterclockwise, axle A is the output axle presents clockwise speeding down restricting torsion output.

---- Regarding (6) axle B to be the primary axle as

looking at it from the direction of the arrow, it performs bidirectional driving, axle A is the output axle presenting the feature of the combination of (4) and (5); if to install the single direction axle adversely, it is able to attain the same function in adverse direction.

Source of the motive force to drive the above axle A engine, or natural force or driving it by man power. The above restricting torsion driving device may be radial structure or axial structure and also to constitute the driving wheel with nonskid gear or chain wheel and constitute the driving wheel with sliding belt pulley or friction wheel to produce friction driving or sliding directly, it is applicable to the organism with brief sliding time especially.

The further application of the above design is to increase the middle section wheel train to the original setable torsion sliding driving wheel set and the driving wheel set providing the function of single direction driving as shown in Figure 5, different ratio of transformation to be increasing or decreasing presents between the middle section wheel trains, and the driving wheels of the middle section wheel sets to be installed on the axles of the middle section wheel trains will be coupled with various independent setable torsion driving devices (the torsion may be the same or selected additionally), and the driving wheel of the middle section wheel set to be installed on the axle of the driving wheel providing the function of single direction driving has also the single direction driving bearing with same action direction, the structure is able to cause the above two

section wheel train to become the wheel train with more sections along with the enlargement of the ratio of transformation of the load torsion to reduce the throw, and the multiple section structure includes the increasing ratio of transformation type and the decreasing ratio of transformation type or mixed type.

In the above application, the principle of the option of the middle section wheel train torsions are as follows:

(1) While the last section is the increasing ratio of transformation of maximum speed up section, the torsion of the setable torsion device 316 between the middle section driving component and the axle is larger than the torsion of the last section setable torsion device 306, the direction of the single direction bearing 315 between the middle section component and the axle is the same as that of the last section.

(2) While the last section is decreasing ratio of transformation of maximum speed down section, the torsion of the middle section setable torsion device 316 is smaller than the torsion of the last setable torsion device 306.

(3) While the application is connected in series or in parallel, the principle of option will be the same as above.

FIG. 4 is an embodiment of the multi-speed gears further made into a coupling structure which may reduce the gliding speed difference of the limited torque bearing at higher speed and decrease the loss thereof. The relationship between and function of related settable torsion device and one-way bearing are the same as shown in FIG. 3.

The embodiment of more sections, it is also to be based on the above principle and so first, to be applied to same direction driving chain wheel or belt pulley is also able to be based on the above principle and so forth.

The above embodiment are exemplary applications, the principle of the present design is able to be practised based on the following principle of option, the function and principle remain the same:

---- Single direction bearing is able to be installed between one of the components of the driving components set to be coupled mutually to drive and the coupling axle;

---- The setable torsion sliding component is able to be installed between one of the directly coupled driving components set and the coupling axle.

In addition, it is also able to connect in parallel with the controllable master clutch to constitute nonharmonious unequal ratio complex number wheel train cross linking-up wheel train and the application device, Figure 5 is the schematic drawing of embodiment, an excessive torsion detection device is installed further for the mechanical type setable torsion device as shown in appendix (1), and a master clutch set 503 to be controlled by the torsion detection device 502 is installed in parallel between the driving wheel 501 to by coupled with the setable torsion device originally and the driving structure of the axle to transmit the coupling torque between the driving wheel and the axle in common, once the setable torsion becomes excessive, the setable torsion device successive sliding of the excessive torsion detection device 502 is provided to maintain the detection signal of the excessive torsion detection device to be in the state of excessive torsion to cut off the master clutch set 503. In the application of eddy coupling or electromagnetic driving, it is to retain smaller electromagnetic coupling force to maintain the state of the detection of the excessive torsion. On account of the

majority of the coupling force moment to be loaded by the master clutch, while the load torque is reduced to be within the coupling torque of the setable torsion device or the load becomes empty-loaded, the excessive torsion detection device will control the opening and closing of the master clutch. Figure 6 is the schematic drawing of the feature of the action of Figure 5; the above excessive torsion detection device may be constituted by electrical machinery electronic or hydrokinetic-type structure to match up with eddy c upling type, electromagnetic driving type, hydrokinetic-type or mechanical action type structure to be used as the master clutch of switch.

To sum up, by means of the single direction driving device to be provided in the cross coupling driving system of the nonharmonious unequal ratio complex number wheel train and the mutual action of the driving of the restricting torsion driving device, it is able to provide the output ratio with different speed ratio following the ratio of transmission of the load automatically or provide the output ratio with different speed ratio once obverse or reverse turning is produced and applied to various driving structures, the present invention is innovative and practical.

The claims defining the invention are as follows:

1. A cross coupling linking-up wheel train of nonharmonious unequal ratio complex number wheel trains and the device of application providing the operation and the device of application with different speed ratio differential nonharmonious cross linking-up wheel trains for the application of automatic following the ratio of transmission of the load or providing different output speed ratio on the occurring of obverse and reverse turning, the structure comprising the installing of the driving wheel train with different speed ratio to be able to slide along with the torsion between two driving axles and the driving wheel train providing the function of single direction driving, in which

---- axle A is used to perform the single direction revolution or obverse and reverse revolution of the input or output;

---- the driving wheel train comprising the gear, friction wheel, belt pulley and chain wheel to be constituted separately or in combination, in which the driving wheel 101 being locked steadily on axle A; driving wheel 104 being locked steadily on axle B; driving wheel 102 being combined with the restricting torsion coupler 106 which is able to restrict the transmission torsion and inserted into axle A to be coupled with the driving wheel 104 of axle B; driving wheel 103 being combined with a single direction bearing 105 (or other single direction device) and then inserted into axle B; the feature being that the speed ratio of the driving wheels 101 and 103 is different from that of the driving wheels 102 and 104; the

restricting torsion being to produce sliding idle running on the driving wheel 102 and the axle A once excessive transmission torsion exists between them;

Based on the above principle of the structure, while the driving wheel 103 drives counterclockwise against the single bearing of the axle B, and the driving wheel 102 being larger than the driving wheel 104 and the driving wheel 103 being larger than the driving wheel 101, the application comprising:

(1) axle A being the primary axle to drive clockwise as looking it from the direction of the arrow, axle B being in the state of an output axle;

(2) axle A being the primary axle to drive counterclockwise as looking it from the direction of the arrow, axle B being in the state of an output axle;

(3) axle A being the primary axle to perform bidirectional driving as looking it from the direction of the arrow, axle B being in the state of an output axle;

(4) axle B being the primary axle to drive clockwise as looking it from the direction of the arrow, axle A being in the state of an output axle;

(5) axle B being the primary axle to drive counterclockwise as looking it from the direction of the arrow, axle A being in the state of an output axle;

(6) axle B being the primary axle to perform bidirectional driving as looking it from the direction of the arrow, axle A being in the state of an output axle;

2. The cross coupling linking-up wheel train of nonharmonious unequal ratio complex number wheel trains

and the device of application as stated in claim 1, the application of which comprising:

(1) axle A being the primary axle to drive clockwise as looking at it from the direction of the arrow, axle B being an output axle, while axle B revolves and the load of axle B is lower than the transmission torsion of the restricting torsion driving device, on account of the driving wheel 102 causing the driving wheel 104 to speed up, and the speed of the driving wheel 103 being slower owing to its diameter being larger than that of the driving wheel 101, idle running formed on the driving wheel 103 against axle B, by this time axle B being sped down to output counterclockwise with moderate speed; if the load of the axle B to be increased exceeding the rated torsion of the restricting torsion driving wheel 106, sliding would occur between axle A and the driving wheel 102 to cause axle B to receive the driving of the driving wheel 201 against axle B, by this time axle B being sped down to output counterclockwise with moderate speed; if the load of the axle B to be increased exceeding the rated torsion of the restricting torsion driving device 106, sliding would occur between axle A and the driving wheel 102 to cause axle B to receive the driving of the driving wheel 201 against the driving wheel 203 to output in same direction with lower speed and larger torsion, the design is able to be applied to the driving of electric tools, hoist, communication machinery or mechanical structure;

(2) axle A being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, axle B being the output axle to be sped down to

output clockwise only;

(3) axle A being the primary axle to perform bidirectional driving as looking it from the direction of the arrow, axle B being the output axle to provide the feature of the combination of (1) and (2); if to install the single direction bearing adversely, allowing same function in adverse direction to be able to attain;

(4) axle B being the primary axle to drive clockwise as looking at it from the direction of the arrow, axle A being the output axle to be sped up to output counterclockwise, and allowing the driving wheel 102 to produce sliding against the axle A via the restricting torsion driving device;

(5) axle B being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, axle A being the output axle to be sped down to perform restricting torsion output clockwise;

(6) axle B being the primary axle to perform bidirectional driving as looking at it from the direction of the arrow, axle A being the output axle to provide the feature of the combination of (4) and (5); if to install the single direction bearing adversely, allowing same function in adverse direction to be attained.

3. The cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device of application as stated in claim 1 comprising to be applied to the driving organism in same direction and the primary wheel and driving wheel being chain wheel to drive by means of chain or belt pulley to

be driven by the belt, in which

---- the driving wheel being locked steadily on the axle A; the deriving wheel 204 being locked steadily on the axle B; driving wheel 202 being combined with a restricting torsion coupler 206 which is able to restrict the transmission torsion and inserted into axle A to drive together with the driving wheel 204 of the axle B in the same direction by means of the chain or bolt; the driving wheel 203 being combined with a single direction bearing 205 (or other single direction driving device) and inserted into axle B; the feature of which being that the speed ratio of the driving wheels 210 and 203 with that of the driving wheels 202 and 204 being different; allowing the restricting torsion coupler to produce sliding idle running in case excessive torsion existing between the driving wheel 202 and the axle A;

According to the above principle of structure, while single direction bearing 205 allowing the driving wheel 203 to drive clockwise against axle B as looking at it from the direction of the arrow, and the driving wheel 202 being larger than the driving wheel 204, the driving wheel 203 being larger than the driving wheel 201, the application comprising:

(1) axle A being the primary axle to drive clockwise as looking at it from the direction of the arrow, axle B being in the state of an output axle;

(2) axle A being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, axle B being in the state of an output axle;

(3) axle A being the primary axle to perform

bidirectional driving as looking at it from the direction of the arrow, axle B being in the state of an output axle;

(4) axle B being the primary axle to drive clockwise as looking at it from the direction of the arrow, axle A being in the state of an output axle;

(5) axle B being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, axle A being in the state of an output axle;

(6) axle B being the primary axle to perform bidirectional driving as looking at it from the direction of the arrow, axle A being in the state of an output axle;

4. The cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device of application as stated in claim 3 comprising the following applications:

(1) axle A being the primary axle to drive clockwise as looking at it from the direction of the arrow, axle B being the output axle, while axle A revolves and the load of axle B is lower than the transmission torsion of the restricting torsion driving device 206, on account of the driving wheel 204 being sped up by the driving wheel 202, owing to the diameter of the driving wheel 203 being larger than that of the driving wheel 201, the speed being lower to form idle running against the axle B, and allowing axle B to output with the higher speed; if the load of axle B being increased to exceed the rated torsion of the restricting driving device, sliding will be produced between the axle A and the driving wheel 202 to cause axle B to receive the driving of the driving wheel

201 against the driving wheel 203 to output in same direction with lower speed and larger torsion, the design is applicable to the driving of electric tool hoist, communication machinery or mechanical structure;

(2) axle A being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, only axle B being the output axle to be sped down to output and the driving wheel 202 presenting sliding idle running;

(3) axle A being the primary axle to perform bidirectional driving as looking at it from the direction of the arrow, axle B being the output axle to provide the feature of the combination of (1) and (2); if to install the single direction bearing adversely to cause the driving wheel 203 to drive counterclockwise against the axle B, the same function in adverse direction will be attained;

(4) axle B being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, axle A being the output axle to be sped down to perform restricting torsion output clockwise;

(5) axle B being the primary axle to drive counterclockwise as looking at it from the direction of the arrow, axle A being the output axle to be sped up to output counterclockwise, and allowing the driving wheel 202 to produce sliding against the axle A via the restricting torsion device 206;

(6) axle B being the primary axle to perform bidirectional driving as looking at it from the direction of the arrow, axle A being the output axle, to provide the

feature of the combination of (4) and (5); if to install the single direction bearing adversely to cause the driving wheel 203 to drive counterclockwise against the axle B, same function in adverse direction will be attained.

5. The cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device of application as stated in claim 1, in which the source of the motive force to be used to drive axle A or axle B may comprising those of motor, engine or the mechanical revolution of natural force or to be driven with man power, the restricting torsion driving device allowing to be radial structure or axial structure, and also unskid gear or chain wheel and sliding belt pulley or friction wheel to constitute the driving wheel to produce direction driving or sliding directly and applicable especially to the organism of the application with brief output and sliding time.

6. The cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device of application as stated in claim 1, the further application allowing to increase the middle section wheel train to the driving wheel set which is able to set the torsion sliding originally and the driving wheel set providing the function of single direction driving, different increasing or decreasing ratios of transmission existing between middle section wheel trains, and the driving wheels of the middle section driving wheel

sets to be installed on the axle of the setable torsion driving wheel being coupled with the independent setable torsion driving device (the torsion may be the same or selected additionally) and independent single direction driving bearing in same action direction to be installed also on the driving wheel of the middle section wheel set and installed on the axle of the driving wheel providing single direction driving function, the structure causing the above two section structure to be enlarged along with the ratio of transmission of the load torsion to becoming to have more sections to reduce the throw, the multiple section structure comprising increasing speed ratio type, decreasing speed ratio type or mixing type;

In the above application, the principle of the option of the torch of the middle section wheel trains being described as follows:

(1) while the last section being the increasing speed ratio of the maximum speeding up section, the torsion of the setable torsion device 316 between the middle section driving component and the axle being larger than that of the last section setable torsion device 306, the direction of the single direction bearing 315 between the middle section component and the axle remaining the same as that of the last section;

(2) while the last section being the decreasing speed ratio of the maximum speeding down section, the torsion of the middle section setable torsion device 316 being smaller than that of the setable torsion device 306 of the last section;

(3) to be applied in series and in parallel, the

principle of option remains the same as above;

The embodiment of more sections allowing to be referred by the analogy of the above principle, and the application to same direction driving chain wheel or belt pulley being referred also by the analogy of the above principle.

7. The cross coupling linking-up wheel chain of the nonharmonious unequal ration complex number wheel trains and the device of application as stated in claim 6, the application of plural sections more than two sections may make the multi-speed gears into a coupling structure which may reduce the sliding speed difference of the limited torque bearing at higher speed and further decrease the loss thereof.

8. The cross coupling linking-up wheel chain of the nonharmonious unequal ratio complex number wheel trains and the device of application as stated in claims 1, 2, 3, 4,5,6 or 7 , the structure comprising:

---- single direction bearing being able to installed between one of the mutually coupled driving components and the coupling axle;

---- the setable torsion sliding component allowing to be installed between one of the directly coupling driving components and the coupling axle.

9. The cross coupling linking-up wheel train of the nonharmonious unequal ratio complex number wheel trains and the device of application as stated in claims 1, 2, 3, 4,5,6 or 7 being constituted further mainly by connecting controllable master clutch in parallel to install further the excessive torsion detection device together with the

mechanical type setable torsion device, and connecting a master clutch set to be controller by the torsion detection device in parallel between the driving wheel which is able to be coupled with the setable torsion device originally and the structure of the driving of the axle transmit the coupling torque between the driving wheel and the axle in common, in case of the occurring of excessive torsion, the setable torsion device providing with excessive torsion detection device sliding continuously to maintain the detection signal of the excessive torsion detection device to be in the state of excessive torsion to cut off the master clutch set, in the application of the eddy coupling type or electromagnetic driving type the smaller electromagnetic coupling force being allowed to retain in order to maintain the state of the detection of excessive torsion, on account of the majority of the coupling force moment allowing to be borne by the master clutch, while the load torque to be reduced to be within the coupling torque of the setable torsion device or the load becoming empty-loaded, allowing the excessive torsion detection device to control the closing of the master clutch; the above excessive torsion detection device set allowing to be constituted by electrical machinery, electronic or hydrokinetic-type machine to match up with the eddy coupling type, electromagnetic driving type, hydrodynamical or powered action and used to be the master clutch of a switch.

10. A cross coupling linking-up wheel chain substantially as hereinbefore described with reference to the drawings.

DATED this 2nd day of July, 1992.

TAI-HER YANG
By His Patent Attorneys
DAVIES COLLISON CAVE

ABSTRACT

The coupling of conventional mechanical wheel train is limited to be between axle and axle, if complex number wheel trains were coupled, the cross coupling wheel train of the driving wheels have identical driving ratio; otherwise the phenomenon of being in mesh and unable to drive will occur. The present invention is to provide an innovative device for the operation and application of different speed ratio differential non-harmonious cross coupling wheel train for the application of the change of the speed ratio according to load automatically or providing different output speed ratio on the occurring of obverse and reverse turns.

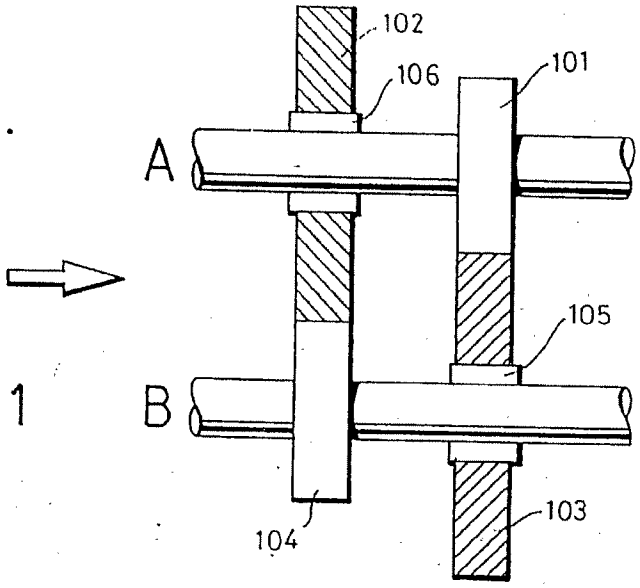


FIG. 1

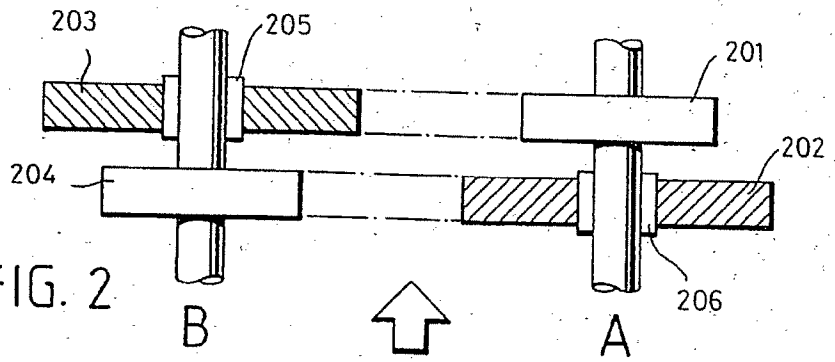


FIG. 2

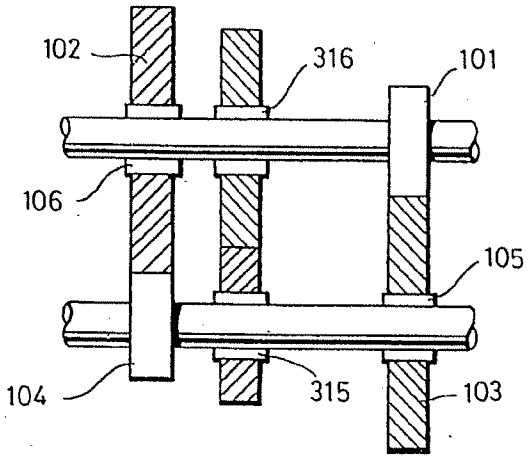


FIG. 3

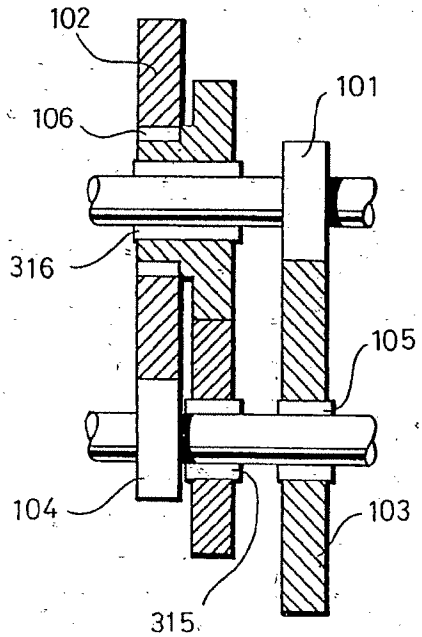


FIG. 4

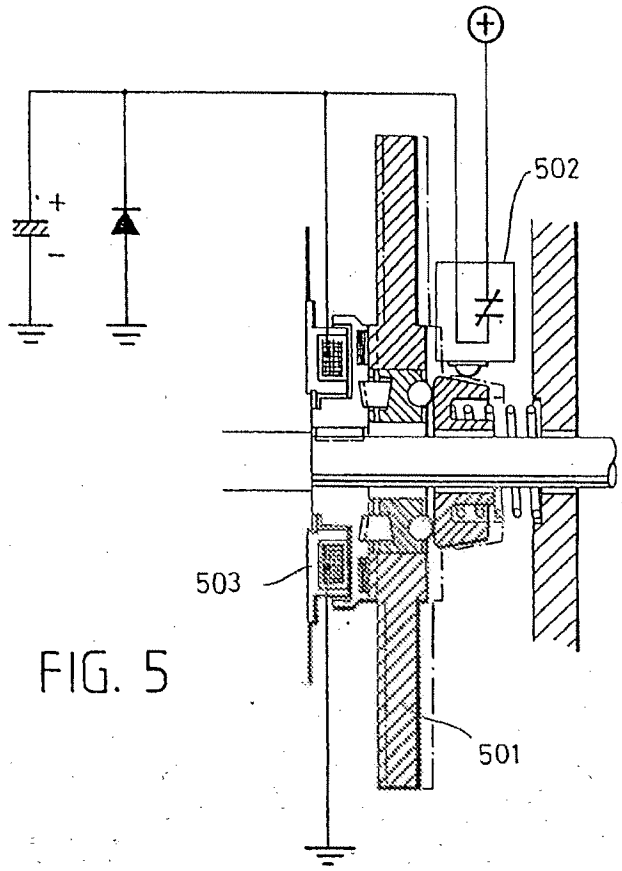


FIG. 5

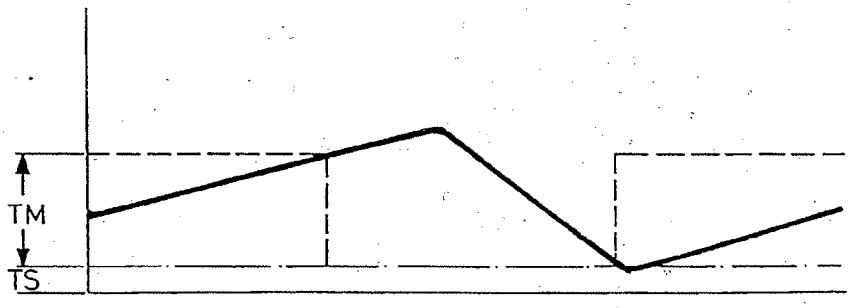
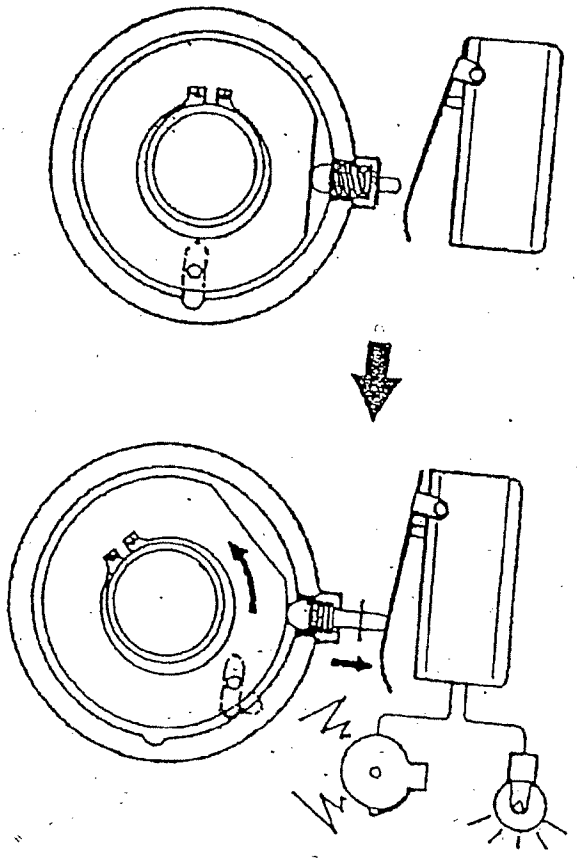


FIG. 6



APPENDIX (1)